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MIRO Class A Power Quality Logger and Analyser

Australia's first Class A Power Quality Analysers designed and manufactured in Australia by CHK Power Quality

The ***MIRO*** Class A range of portable power quality recorders are precision instruments that offer comprehensive and reliable compliance monitoring of low voltage circuits. Built for high performance, toughness and focus on ease of use, the MIRO range are the workhorse instruments of choice for a variety of power monitoring applications including power quality analysis, supply compliance checks and voltage investigations, power flow studies, energy audits, solar and railway systems and transformer monitoring.

Models

Single phase:

- PQ25 (2 voltage and 2 current channels)

Three phase:

- PQ35 (3 voltage and 4 current channels); and
- PQ45 (4 voltage and 4 current channels).

Key hardware features

- Certified to IEC61000-4-30, Class A
- Compact design to meet applications for the modern marketplace and where space and accessibility are restrictive.
- AC and DC voltage and current measurements.
- Isolated voltage inputs (each channel has its own neutral) facilitate various wiring configurations.
- Two temperature channels.
- Expansion port allows for system expansion to include additional sensors, input/output controls and custom interfaces which broaden the PQ system platform. Example interfaces include DGA, Hydrogen and Bushing monitors.
- All weather conditions: rugged, shock resistant, portable and weatherproof (IP66).
- All local (WiFi) and remote communications options (2G/3G/4G) are integrated within the enclosure - no additional peripherals required other than an external antenna.



Figure 1: MIRO PQ35 - Three phase power quality logger and analyser

- Safety
  - Voltage transients: Minimum CAT IV 600V
  - > 10kV isolation to ground
  - > 10kV isolation between voltage channels
  - Detachable voltage and current leads
  - Voltage leads independently certified to CAT IV 600V (PQ45 only)
  - Reinforced insulation / double insulated
- Powered from Phase A to Neutral or an external DC.
- GPS included as standard, only require an external GPS antenna.
- Graphical colour display
  - Voltage and current waveforms.
  - Phasor diagrams.
  - Measurements.
  - User defined screen.
- Internal backup battery: 5 minute back up time as standard, with option to extend upon request.
- Starts logging on power up.
- Gapless logging: User can download data, clear log memory and configure the device with no interruption to logging.

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- Concurrent logging at multiple log intervals: 10/12 cycles, 150/180 cycles, 10s, 10m, 2h, and user settable.
- Mains signalling included as standard.
- Logged memory: 8GB.
- Accessories
  - All PowerMonic PM35 and PM45 accessories can be used with the PQ35 and PQ45 models respectively.
  - No external power required for DC current clamps.
  - Two temperature probes as part of the standard kit.

Key software (CITRUS) features

- The CITRUS platform is powerful, easy to use and intuitive application software that supports all CHK PQ products. It provides tools for: device management; data analysis; and reporting.

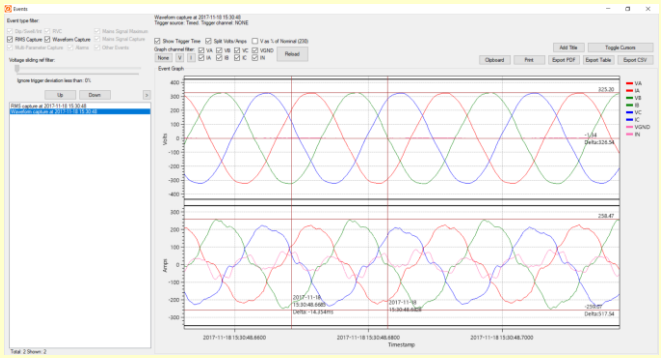


Figure 2: CITRUS - Event - waveform capture

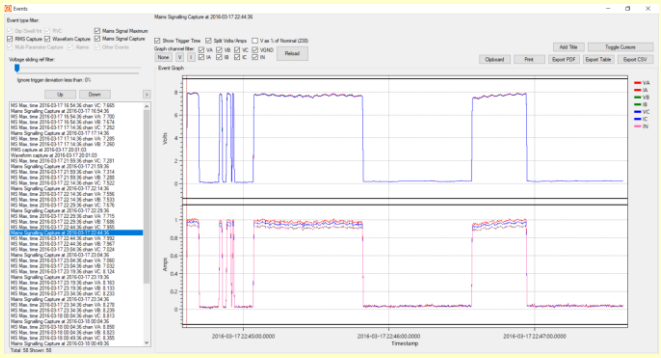


Figure 3: CITRUS - Event - Mains signalling capture

- Configurations
  - Pre-defined configurations for easy setup.
  - Create and store different configuration files for quick retrieval.
- Online monitor, with event trigger option (ideal for motor starts).
- View different log file data on the same graph to compare PQ measurements (use GPS to time synchronise loggers).
- Event type filter included, to view desired events; examples shown below.
- Analysis and Compliance reporting
  - Voltage compliance profiles available;
  - User definable voltage compliance profiles.
  - Harmonic compliance report available.
  - Energy; Daily Min/Max; ITI (CBEMA) curve.
- Customised reports (available upon request).

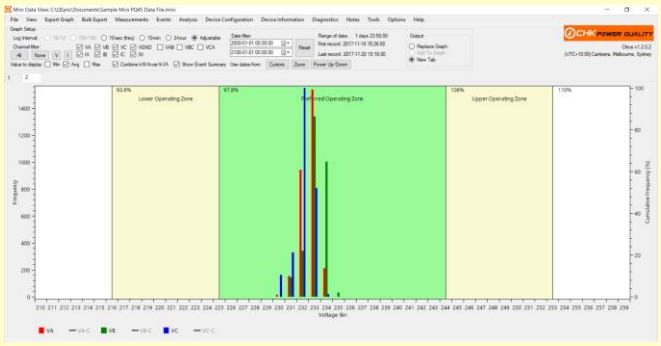


Figure 4: CITRUS - Voltage compliance report as per AS61000.3.100



Figure 5: CITRUS - Harmonic compliance report as per AS61000.2.2

- Views
  - Ability to edit an active view: Text and arrow annotation and title options available.
  - Generate a PDF, CSV file, or table.
  - Save and Print view.
  - Split or combine voltage and current graphs.
  - Multiple measurements on a single graph.
  - Horizontal and vertical cursors for accurate measurements.

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- Horizontal and vertical axes zooming functions.

Benefits

Local product

- Designed and made in Australia
- Support - direct from the manufacturer
- Regular software and firmware updates
  - Can add new features on request

Operate directly from mains voltage

- Built in Phase A power supply to cover full 600V operating range
  - No external supplies or batteries required for any current sensor/GPS/modem

External supply and backup

- External 12V DC power available
- Backup battery to cover interruptions up to 5 minutes
  - Option for larger battery

Current sensors

- Automatic identification and scaling of current sensor inputs
- Compatible with all PowerMonic voltage leads and current sensors
- Wide range of current sensors
  - 1A and 5A converter (banana terminals)
  - Small and large clamp CTs, 10A to 1000A
  - Flexible rogowski coils, including a high-sensitivity coil
  - Hall sensor for DC (no power supply required)

Channel isolation

- Safety:
  - Cat IV 600V (PQ45 only)
  - >10kV voltage isolation
- Individual voltage channels are isolated
  - No common ground or neutral required
  - Many possible circuit connections (star, delta, split phase, etc.)
  - Can easily measure input and output of LV transformers (CVTs, isolation transformers, etc.)
  - Common-neutral cable available to simplify connections if split channels aren't needed

Portability

- Portable
  - Small and light, but no compromise on safety or features
- Connectors for all inputs
  - No wires hanging around when setting it up
- IP66 – no external housing required

Fully class A compliant

- Full Class A compliance both for online mode and for logged data
  - High accuracy
  - Repeatable, comparable measurements
  - 10/12 cycle base interval can be logged for all parameters

Logging

- Concurrent logging at all Class A intervals plus a user-adjustable interval
  - No need to "re aggregate" in software
  - Can do 10 minute logging for voltage and harmonic compliance plus faster logging for diagnostic purposes, at the same time

Mains signalling

- Multiple mains signalling options
  - Maximum level only
    - Daily maximum table available
  - 10/12 cycle (200ms) capture up to five minutes
    - Voltage and current
    - Can also capture total RMS
  - Fast 20ms capture

Memory

- 8GB memory
  - Log for up to two years with default configuration
- No lossy compression or other "shortcuts" to extend memory capacity at the cost of accuracy and/or standards compliance

Gapless logging

- Full gapless logging
  - Can download, reconfigure and clear at any time without stopping the logging
  - No interruption or gaps introduced
  - Suitable for fixed or long term monitoring
  - Maximises user convenience even if gapless logging is not required

Fast and easy

- Fast downloads - 60 to 120 MB per minute
- Fast configuration, easy to reset back to defaults
  - All configuration is in a single form
- Fast clearing – less than a second
- Easy firmware updates
  - No special tool or procedure required
  - No need to clear memory or configuration
  - Unit will restart when firmware upload completes and resume logging immediately

GPS and remote communications

- Built in GPS
  - Time sync required for Class A
- Fully integrated remote communications
  - Direct connection – equivalent to USB connection
  - Automatic uploads by FTP

No buttons

- No buttons
  - Automatically logs on power up unless configured otherwise
  - No risk of forgetting to log

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Display

- LCD:
  - Clearly display logging status
  - Quickly verify correct installation
  - Waveform display available
  - High update rate – every 10 or 12 cycles

Citrus

- Software:
  - Free
  - Small download, easy and fast to install
  - Built for both 32 and 64 bit Windows
  - Supports all Windows versions from XP through to 10
  - Main executable is portable – can view data files without installation and without administrator privileges
  - Digitally signed to verify it came straight from us
  - Easy to use
  - Familiar for existing PowerView users
  - Multiple data windows allowed, or add multiple files to the same window
  - Tabbed view to quickly compare different graphs
  - Easily add additional parameters to graphs
  - Cursors, text and arrow annotations available
    - Tied to data, not to position on screen
    - Correct position maintained when panning and zooming
  - Zooming
    - Click and drag or by scroll wheel
    - Zoom multiple axes or a single axis at a time
    - Quickly reset zoom on double click
  - Convert graph to table or CSV file
  - Date/time range and channel selection available for all parameters and analysis charts
  - Analysis features built in:
    - Voltage compliance
    - Harmonic average over the log
      - Harmonic compliance
        - Voltage and current
    - Daily minimums and maximums
    - Total energy
      - Hourly energy profile
        - Split imports/exports – useful for solar installations
  - PQDIF export – “PQView” compatible (under development)

Hardware specifications

PARAMETER	DESCRIPTION
Power quality parameters	
Class A declared/nominal input	230V 50Hz/60Hz
Power frequency	IEC61000-4-30 (section 5.1).
Magnitude of the supply voltage	IEC61000-4-30 (section 5.2).
Flicker	IEC61000-4-30 (section 5.3).
Supply voltage dips and swells	IEC61000-4-30 (section 5.4).
Voltage interruptions	IEC61000-4-30 (section 5.5).
Supply voltage unbalance	IEC61000-4-30 (section 5.7).
Voltage harmonics	IEC61000-4-30 (section 5.8).
Voltage interharmonics	IEC61000-4-30 (section 5.9).
Mains signalling voltage on the supply voltage	IEC61000-4-30 (section 5.10).
Rapid voltage changes (RVC)	IEC61000-4-30 (section 5.11).
Underdeviation and Overdeviation	IEC61000-4-30 (section 5.12).
Measurement	
A to D Conversion	16 bits.
Samples per cycle	384 @ 50 Hz; 320 @ 60 Hz.
Sampling Rate	Nominal: 19.2kHz synchronised to mains.
Anti-aliasing	High-frequency components attenuated by at least 50dB so as not to interfere with harmonic measurements.
Measurement metrics	
Frequency	Range: 50Hz nominal (42.5-57.5)Hz, 60Hz nominal (51.0-69.0)Hz;

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	Full range: (40-70)Hz. Measurement: 10s; Accuracy: ±5mHz referenced to RTC, ±1mHz referenced to GPS.
Magnitude of the supply voltage (true RMS)	Measurement: 10/12 cycle rms Range: 10% to 150% of nominal value with accuracy of ±0.1% of nominal value under conditions specified in IEC61000-4-30 section 6.1.
Flicker	IEC61000-4-15, 10 minute Pst (short term) and 2hr Plt (long term).
Dips and swells	Measurement: 1-cycle rms updated every half cycle. Accuracy: ±0.2% of nominal value, ±1 cycle. Range (magnitude) 0 to 200%. Range (duration) minimum 0.5 cycles by definition. No upper limit.
Voltage interruptions	Measurement: 1-cycle rms updated every half cycle. Accuracy: ±1 cycle. Range (duration) minimum 0.5 cycles by definition. No upper limit.
Voltage and current unbalance	Applicable 3 phase systems and evaluated using the method of symmetrical components. Metrics: u_2 = (U2/U1) and U_0 = (U0/U1). U0, U1 and U2 are sequence components. Range: 0.5% to 5% of U_2 and U_0. Accuracy: ±0.15%.
Power meter	Power-kW, Power-kVA, Power-kVAR, True Power Factor (TPF), Displacement Power Factor (DPF).
Voltage harmonics / interharmonics	IEC61000-4-7, Class I (up to 50th harmonic). Range: 10% to 200% of Class 3 electromagnetic environment in IEC 61000-2-4. Metrics: voltage and current magnitude and angle. 51st to 100th: Indication only.
Total harmonic distortion (THD)	IEC61000-4-7, THDS (up to 50th harmonic)
Mains signalling (Ripple amplitude)	Signal: <3kHz, user specified frequency. 20Hz bandwidth (4-nearest-bins method, adjusted automatically to correct for fundamental drift). Measurement: 10/12 cycle rms amplitude maximum value. Measurement range: 0%-15% of the nominal value. Detection threshold: >0.3% of nominal voltage, Duration: user defined from 1s to 300s. Trigger input to Ripple capture.
RVC	RVC threshold: user defined between 1% and 6% of the nominal value. RVC hysteresis: user defined and < RVC threshold.
Underdeviation / Overdeviation	Separately measure voltages above and below the nominal value. Metrics: RMS-under, %U $_{Under}$ and %U $_{Over}$.
Crest factor	Indicates peak-to-rms ratio of waveform. ±1%.
Temperature	Two temperature channels measured each second, recording at adjustable, 10-min and 2-hour intervals. Measurement:-50°C to +150°C. Accuracy: ±1°C.
High speed event recording	
Triggers	User defined. Sliding reference, Dip/Swell, transient (dv/dt), manual (via Online Monitor)
Event waveform capture	User defined. Pre-trigger: 100ms; Post trigger: 400ms; Option for extended capture (eg. motor start). Duration: 2s.
Event RMS capture (half cycle RMS)	2.5s pre trigger, 25s post trigger (50Hz)
Ripple capture (10/12 cycle RMS)	Duration: 1s to 300s. Triggered by exceedance of detection threshold (see above).
Communications	
Wired data (standard)	USB 2.0.
Wireless (options)	Local and remote wireless options will be available and integrated within the instrument.
Logging	
Logged data memory	8GB.
Logging intervals	All IEC61000-4-30 intervals simultaneously plus adjustable interval from 1s to 3600s.

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Measurements	All measurements simultaneously.
GPS location	GPS location coordinates logged periodically.
General	
Circuit connections	Three phase delta, three phase Wye, split phase* & single phase.
Data file	PQA format binary with CSV export.
Data display	Real time measurements of basic parameters via LCD, all parameters via Online Monitor.
Software tools	CITRUS.
Inputs	
Voltage channels (AC/DC)	Isolated. 3 or 4 independent 2-wire inputs depending on model and voltage lead options.
Voltage range (working maximum per isolated input pair)	Powered from phase A: 600VACrms (850Vpk) Internal supply disabled: 700VACrms (1000Vpk)
Voltage surge protection (differential)	4kV Fast transients, 6kV 1.2/50us impulse – no effect. Recalibration may be required after impulses significantly exceeding 6kV.
Current channels (AC/DC)	4. Hall effect clamp-on sensor required to measure DC.
Current range	Dependent upon current sensor.
Temperature channels	2 x PT100 RTD, M8 connectors.
Expansion Module Port	UART / SPI interface for future system upgrade. Allows for additional sensors (e.g. current, voltage, temperature, DGA), analogue I/O (e.g. 4-20mA/0-5V/0-10V), digital I/O and relays.
Accessories	Compatible with PM35 and PM45 accessories. Temperature sensors are PT100 RTD Class B.
Instrument type	IEC61000-4-30, Class A.
Current Sensors	Flexible current probes or clamp-on current probes with automatic detection.
Accuracy	
Reference conditions	22ºC.
Current (instrument)	±0.2% of full scale. System accuracy depends on sensor.
Voltage	±0.1% of nominal value as specified above.
Voltage temperature coefficient	Approx. 25ppm/C
Environment and safety	
Use	Indoor and outdoor.
Altitude	Up to 2000m.
Operating Temperature	-20°C to +60°C.
Relative Humidity	20% to 99% Relative Humidity.
Degree of Protection	IP66 (all weather housing).
Certifications / type testing	
EMC	EN55022:1998 _A1:2000 +A2:2003 CLASS A.
Salt Spray (Corrosion)	MIL STD 810 G.
Outdoor weathering (UV)	IEEE 495:2007 or equivalent.
Random Vibration	MIL STD 810 G.
Impact Test	IEEE 495:2007 or equivalent.
Safety Category	IEC 61010-1, Pollution degree 3; CAT IV 600V (PQ45 model), >10kV withstand.
Power	
Power supply	Phase A voltage, range: (60-600)VACrms; 15VA typical.
USB powered (Mini USB)	Configuration and download.
External DC supply	Plug pack provided.
Backup power	Rechargeable battery - $LiFePO_4$.
Backup battery duration	5 minutes. Longer duration (30 minutes with 24 hours recharge) available on request.
Timing	
Real time clock (RTC) battery	Non rechargeable Lithium backup battery. Functional life: > 10

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	years.
RTC	Typical ±3ppm from -15 to 60C. Drift <1 second per week.
GPS (internal)	Time accuracy: <1ms. External antenna required.
Mechanical	
Display	Colour graphic LCD (4.3" 480x272 Graphic TFT LCD); Dimensions: (97 x 56) mm.
Enclosure dimensions	(180 x 130 x 60) mm; Length side ports: Current and voltage channels; Width side ports: Data, temperature and expansion module i/o connectors.
Weight	1.05kg (instrument only).
Case material and colour	Polycarbonate, moulded in light grey.
Boot	Soft flexible boot for protection.

Software specifications

FEATURE	DESCRIPTION
General	
Software platform	CITRUS – software platform used to manage all company products.
Application launch	Automatically when clicking on a CITRUS file.
Miro data View	
File	
Features	Open; Open Recent; Add File; Remove File; Exit.
View	
Features	Save view to log file; Load saved view; Set Zoom; Cursors; Add Title ; Add Notes as Footer; Add Text Annotation; Add Arrow Annotation; Toggle Split/Combine; Toggle Date/Time mode ; Close Tab.
Export	
Features	Prints current graph; Generates PDF of the current graph; Generates PNG of the current graph; Generates SVG of the current graph; Generates clipboard of the current graph; Generates CSV of the current graph. Custom CSV upon request; Generates Table of the current graph.
Measurements	
RMS and Frequency	Graphical view of logged: TRMS; AC; DC, Crest Factor; Fundamental Magnitude; Fundamental Phase; Frequency; Underdeviation; and Overdeviation.
Power and Unbalance	Graphical view of logged: Real Power; Reactive Power; Apparent Power; True Power Factor; Displacement Power Factor; Real Power Total; Reactive Power Total; Apparent Power Total; Unbalance (Negative Sequence); and Unbalance (Zero Sequence).
Harmonics	Graphical view of logged: Harmonic Magnitude; Harmonic Percentage of Fundamental; Harmonic Phase; Interharmonic Magnitude; and THD.
Flicker	Graphical view of logged short term (Pst) and long term (Plt) flicker.
Temperature	Graphical view of logged temperature channels.
Events	
View of events	Dips/Swells/Interruptions; RMS Capture; RVC; Waveform Capture; Mains Signalling Maximum; and Mains Signalling Capture. Listed events change accordingly.
Voltage slider reference filter	Ignores trigger levels less than the set level.
Graphical tools	Split Volts/Amps; Vas a % of Nominal; Graph channel filter (VA,

	VB, VC, VGND, 1A, IB, IC, IN); Load V and I channels; Reload; Clipboard; Print; Add Title; Export PDF; Add Cursors; Export Table.
Analysis	
Harmonic average	Percentage of Fundamental and Magnitude.
Harmonic compliance	Voltage: Percentage of Fundamental; Proportion of Compliance Limits; Set Compliance Limits. Current: Percentage of Maximum Demand; Proportion of Compliance Limits; Set Compliance Limits.
Voltage compliance	Setup; Percentile Table; Histogram.
Daily Min/Max	TRMS, Frequency, THD, TPF, kW, kVAR, kVA, Mains Signalling maximum.
Energy calculator	kWh, kVarh, kVAh, kWh hourly profile, kWh hourly import/export (useful for solar installations) and power .
ITI (CBEMA) curve	
Custom	Upon request.
Device Configuration	
Configuration tabs	Inputs, Log Intervals, RMS and Power, Harmonics and Flicker, Mains Signalling, IEC Events, Capture Triggers, Capture Types, LCD, Comms.
Configuration file	Can append a description.
General configuration features	Load From file; Save To file; Save Config To Device; Reset To Default; Enable All Log Points; Disable All Log Points.
Set log date-time range	Log start, Log stop, Reset.
Data usage estimate	Estimated data per day; Estimated data per month; Days to 100 MB; Days to 1 GB.
Device information	Model, serial number, calibration date, CT types and firmware version.
Notes	Log notes - add text to be viewed as footer.
Tools	
Features	Join Open Files; Split File; Set Voltage Scaling; Set Current Scaling: Custom ratio; CK1/CK5 with 1A/5A CT.
Options	
Features	Display Time Zone; Colour Settings.
Help	
General graphical tools	
Online Monitor	
Features	Ability to view all parameters plus waveforms in real-time. Tabs: RMS and Power; Phasor Diagram; RMS Plot; Harmonic Magnitude (table); Harmonic Magnitude (bar chart); Harmonic Phase; Harmonic Power (bar chart) [Displays direction for selected harmonics, and referenced to the direction of the Power frequency]; Interharmonics; Flicker; Events; Waveforms..
Aggregation interval	10/12 cycle; 150/180 cycle; 10-min; 2-hour; Adjustable.
Sampling rate	Displayed.
Operations Window	
Operations	Online Monitor; Configuration; Download; Clear memory after download; Clear Download Portion; Clear All Memory; Set Time; Update Firmware.
Status information	Mode1; Serial Number; Calibration state; Firmware; Boot Counter; Channel; CT Types; Operating mode; Comms status.
Configuration	
Configuration tabs	Inputs, Log Intervals, RMS and Power, Harmonics and Flicker, Mains Signalling, IEC Events, Capture Triggers, Capture Types, LCD, Comms.
Management Window	

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Open data File	Opens Miro data file with ability to browse.
Connect USB	Connects to the Miro using direct cable connection.
Connect TCP/IP	Enter IP address
Offline configuration (tabs)	Inputs, Log Intervals, RMS and Power, Harmonics and Flicker, Mains Signalling, IEC Events, Capture Triggers, Capture Types, LCD, Comms.
Tools (Join Multiple Files)	Data files must have same serial number (data generated from the same instrument).
Open Recent	Select a Miro file from a list of recently opened files.

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